

Notes on the Biologies of three Species of Bombyliidae, with a Description of one New Species

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These records on biology, while not conclusive, are published in order that more interest might be created toward studying the habits of this fascinating group of flies. Comparatively little is known about the habits of the family, and much work remains to be done in this respect.

The author wishes to express his thanks to the two men, who, through their efforts, have made this paper possible: Mr. H. B. Leech of the California Academy of Sciences and Mr. R. C. Bechtel of the University of California at Davis.

In December of 1952, Mr. Bechtel collected a total of 70 nests of the mud-dauber wasp, *Sceliphron caementarium* (Drury), from various areas around Davis, California. From three of these nests emerged three specimens of *Toxophora virgata* O.S. Of the three nests, one was from the inside wall of a small pump-house and the other two were collected from the underside of a cement bridge. The nests were kept in the laboratory until the spring of 1953. Following is a list of the hymenopterans which emerged from the three nests. From nest number 20, four *Ancistrocerus tuberculocephalus sutterianus* (Saussure), and one *Stenodynerus minimoferus* Bohart; from nest number 24, three *Rygiium foraminatum blandinum* (Rohwer); and from nest number 25, three *Stenodynerus minimoferus*.

Nothing definite can be said about the specific host of *Toxophora virgata* as all three species of hymenopterans, mentioned above, fall within the category of the hosts recorded in the literature. It is unlikely, but not an impossibility, that the fly larvae fed on the *Sceliphron* larvae.

The genus *Toxophora* is found in both Europe and North America, and most of the host records are found from the former continent. Rearing and host records are not numerous

and are scattered, but from the information available, a good indication of the hosts of these flies may be obtained. Séguy (1926)¹ records the genus *Toxophora* as "Parasites des Guêpes solitaires (*Eumenes*, *Pelopaeus*, *Odynerus*)." Osten Sacken (1877)² records a species of *Toxophora* reared from the nest of *Eumenes fraterna* Say, "feeding either upon the caterpillar stored up in the nest, or upon the young larvae themselves." Austen (1937)³ records *Eumenes pomiformis* Fabr. being attacked by the larvae of *Toxophora maculata* Rossi.

In 1951 Mr. Leech collected a quantity of *Ceanothus thrysiflorus* Esch. wood, which was heavily infested with the anobiid beetle, *Ptinus acuminatus* Casey. The wood was placed in a jar and kept there in an attempt to rear some of the beetles. A few months later three bombyliids emerged from the wood, along with several anobiids. The flies proved to be an undescribed species of the genus *Eclimus*.

The cast pupal skins were left protruding, for most of their length, from old anobiid burrows. It was immediately assumed that the beetles served as the hosts. But, at a later date, the spring of 1952, Mr. Leech again collected some wood, this time dead chaparral pea, *Pickeringia montana* Nutt., which was heavily infested with another anobiid, *Vriletta decorata* Van D. From this wood one specimen of *Anthrax oedipus* Fabr. emerged. In this case, by careful tracing it was found that the fly came from a small hymenopterous cocoon in an old anobiid burrow, which had been provisioned with spiders. This later case then makes the previous assumption, that the *Eclimus* species came from the anobiids, open to suspicion as to the host.

The author has been unable to locate any records in the literature on the host, or hosts, of the genus *Eclimus*. He has observed *E. luctifer* O.S. ovipositing in an old log lying near a small stream. All attempts to recover either eggs or larvae failed, and no more information is available at this time.

It was impossible to determine the hymenopteran that served as the host for *Anthrax oedipus*. Species of the genus *Anthrax*

¹ SÉGUY, E. Faune de France, Paris 13: 220.

² OSTEN-SACKEN. Bull. U. S. Geol. Geog. Survey of Terr. 3: 265-66.

³ AUSTEN, E. E. Brit. Mus. Nat. Hist. Publ., London, p. 77.

have been recorded several times as being parasitic on the larvae of solitary bees and fossorial wasps. Osten Sacken (1877) states that he has observed *A. oedipus* in the Sierra Nevada Mountains, persistently flying around a hole in a pine log, probably containing the nest of some hymenopteran. He also records other species in the genus as being reared from *Pelopoeus*, *Cemonus*, *Chalicodoma*, and probably *Megachile*. Brooks (1952)⁴ records and describes the pupal case of *A. irrorata* Say, a species closely related to *A. oedipus*, as being reared from *Megachile nivalis* Fries.

The following is a description of the adult and cast pupal skin of the *Eclimus* species, reared from ceanothus wood. The author takes pleasure in naming this fly after Mr. H. B. Leech.

***Eclimus leechi* n. sp.**

Body black; wings hyaline, subcostal, costal, marginal, and first basal cells with faint infuscations, faint spots on *r-m* cross-vein, base of second submarginal cell and at the bases of all the posterior cells.

Female. Front gray pollinose, blackish in center from vertex to a little beyond middle, black pilose in middle, a few whitish scales present; face gray pollinose, white pilose along oral margin; clypeus when rubbed, shining; antennae black, segment one three times longer than second, shorter than third, third segment broadest before middle, tapering to blunt apex, style wanting, segments one and two with black hair above, white below; proboscis longer than head height; palpi half as long as proboscis, first segment twice as long as the second, slender, segment two broad, tapering to a point, with short black hair; occiput gray pollinose on sides, black on upper one-fourth, white pilose, a few black hairs on vertex, golden-yellow tomentum on vertex, a few golden-yellow scales along hind margins of eyes. Thorax black, white pilose, dense golden-yellow tomentum overall, three, long, black bristles at root of wings; scutellum black, thickly covered with golden-yellow tomentum, long white hair on posterior margin; pleura gray pollinose, white pilose, tomentum want-

⁴ BROOKS, A. R. Canadian Ent. 84: 370.

ing; legs black, tibiae somewhat brownish; coxae white pilose, fore and middle femora entirely white pilose, hind femora white pilose on basal half, grading to iridescent black on apical half, with two short, slender bristles on under surface; halteres with stems whitish, knobs black; wings hyaline, following cells faintly infuscated: subcostal, costal, marginal, first basal, area near stigma darker, faint spots on *r-m* cross-vein, base of second submarginal cell and at bases of second, third, and fourth posterior cells. Abdomen black, first segment white pilose, rest of dorsum with short, black pile, sides of segments one to four white pilose, five to seven black pilose, entire dorsum golden-yellow tomentose, thicker on median line and posterior margins of each segment; venter white pilose and tomentose, segments six and seven with black pile. Genitalia orangish, with a few golden-yellow hairs.

Male unknown.

Type female. Mill Valley, Marin County, CALIFORNIA, VI-25-51 (H. B. Leech). Deposited in California Academy of Sciences. Paratypes. 2 females, same data as type. One specimen in the California Academy of Sciences, the other in the author's collection.

The following is a description of the cast pupal skin of *Eclimus leechi*.

Light yellow, with yellow setae and reddish-brown tubercles.

Head. Round in front view. Cephalic tubercles widely spaced, long, and straight, somewhat ridged near base; a small tubercle arises behind and a little inward of each large cephalic tubercle; frontal tubercle trifid, dorsal tubercle the largest, slightly proclinate, two ventral tubercles small, without long tapering point characteristic of other tubercles, ridged near base; middle of front with lateral depressions; a single pair of setae located behind each cephalic tubercle, about one-half as long as the tubercles; mouth parts short, not extending length of femora; labrum with a pair of small tubercles, a very small seta alongside each tubercle. Dorsum of thorax bare, a thin seta dorso-laterally above root of wings; wings extending to the third abdominal segment, without setae or tubercles. Segment one of abdomen

with a median-dorsal row of small spines, short setae interspersed between each spine, lateral area bare, three short setae at union of dorsum and venter; segments two to six with a median-dorsal row of larger spines, slightly curved upward, a variable number of short setae interspersed between each spine, a pair of setae at each end of each row of spines, three setae at union of dorsum and venter; seventh segment with a row of short spines, and interspersed setae on posterior margin; eighth segment bare, with a pair of slightly curved terminal tubercles; entire venter of abdomen bare.

The pupal skins are attached to the type and paratype specimens.

A Moisture Gradient Method for Rearing Diptera from Moist Humus

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A convenient rearing method has been used with great success by workers at U.C.L.A. to obtain new or little-collected Diptera, especially Nematocera, from moist humus, and to associate the larval and pupal stages with the adult. The procedure involves collecting damp humus or leaf mold in the field and transferring a portion of it to a can set in a pan of water and covered by a rearing cage. Thus moisture gradient is established which will permit immature forms present in the humus to develop and emerge into the cage for a considerable period following their collection.

At U.C.L.A. we use discarded syrup cans $9\frac{1}{2}$ " wide by $12\frac{1}{2}$ " high which contain about one cubic foot of loosely-packed humus over a two-inch layer of salt-free sand. The can, with several small holes punched through its bottom, is set into a pan in which a two-inch water level is maintained. Over the humus can is placed one of our mosquito-rearing cages, measuring 15" by 15" by 36" and made of 32-mesh plastic screen stretched on a frame of $\frac{3}{4}$ " fir, with $\frac{1}{8}$ " masonite top and bottom, a window of cellulose acetate film and a muslin sleeve. The screen, window and sleeve